asked is that descriptions, together with drawings or photographs not only of typical instruments but of the important parts of them, should be sent. Technical drawings also are requested, if obtainable, and these very probably could be obtained from the makers of the instruments in question. Of course it is not required that each observatory should send say a description, &c., of the transit instrument there in use, but it is hoped that any instrument of peculiar construction or special merit should be referred to. It is needless to add that all drawings, &c., if requested, will be returned with as little delay as possible, and the undersigners of the circular thank in advance all those who respond towards the completion of this undertaking. The address to which the drawings, &c., may be sent is as follows:—Dr. L. Ambronn, Göttingen, Kgl. Sternwarte.

MOTION OF β PERSEI.—*Astronomical Journal*, No. 277, contains a short note calling the attention of transit observers to the importance of observation of this variable, to confirm the irregularity in its proper motion. At the present time Algol and his neighbouring stars are conveniently situated, and it is hoped that the following list of stars will be added to working lists generally where their observation is not inconsistent with other work. The places are for the year 1875:—

	R.A.			Decl.	
	h.	m.	s.	°	′
γ Andromedæ	1	56	14	41	43·7
β Trianguli	2	2	7	34	23·7
θ Persei	2	35	40	48	41·9
41 Arietis	2	42	38	26	44·6
γ Persei	2	55	45	53	0·9
ϕ Persei	2	57	10	38	21·3
β Persei	3	0	2	40	28·3
α Persei	3	15	24	49	24·9
δ Persei	3	34	2	47	23·1
ν Persei	3	36	42	42	10·9
η Tauri	3	40	3	23	43·0
ζ Persei	3	46	17	31	30·6
ϵ Persei	3	49	28	39	38·8
ξ Persei	3	50	51	35	25·8

PROPER MOTIONS.—M. Deslandres, in *Comptes rendus* of November 14, communicates the recent work he has been carrying out with regard to the spectroscopic determinations of proper motions. The first part contains a description of the apparatus employed, showing how he has completely altered one instrument specially for this work. During the ten months of the year he has obtained several proofs of stars susceptible of furnishing radial velocity. The following are among some of the important methods of procedure:—(1) The luminous "faisceaux" of the star and of the source of light have the same aperture, and are thus as identical as possible, a condition necessary to the absolute measure of displacements. (2) The displacements of spectra is measured not only with the Hγ line of hydrogen, but with all the hydrogen, calcium, and iron lines. (3) The large surface of the mirror renders the possibility of measuring the velocities of 250 stars. Some of the results already obtained show that the work, when finished, will be of a very reliable and accurate kind. For instance, the velocity of Venus has been obtained instrumentally as 15 kilometers, while that calculated amounted to 13·55 k.m. The velocity of α Auriga on February 5, employing 30 lines of comparison, came out as 43·5 k.m., and the velocities of the components of β Auriga, a spectroscopic double, were obtained on the same day as − 845 k.m. and + 97 k.m.

GEOGRAPHICAL NOTES.

THE measurement of an arc of the meridian between Dunkirk and the Spanish frontier, which has recently been completed with the highest precision by the French Government, shows that the measurement by Delambre and Méchain in determining the length of the metre was 146·6 feet, or $\frac{1}{20000}$th too short. The new measurement accords very closely indeed with the value as deduced from Clarke's ellipsoid.

A NEW weekly paper devoted to African geography, under the title of Kettler's *Afrikanische Nachrichten*, was started at Weimar in July last, with the object of collecting and publishing the most recent information on all matters connected with Africa and the Africans. An ingenious feature is that of giving a sketch map of parts of Africa, with a small section of a map of some well-known part of Germany on the same scale below it, for the purpose of ready comparison of distances.

MR. AND MRS. THEODORE BENT have arranged to spend the winter in Abyssinia studying the ancient monuments of Axum. They will leave this country about the middle of December. We understand that Mr. Bent would welcome a scientific man who might wish to work at any of the natural conditions of eastern Abyssinia, and take advantage of the arrangements which have been made for the safety and comfort of the party. It would, of course, be necessary for such a companion to pay his own expenses and provide his own outfit.

A SPECIAL general meeting of the Royal Geographical Society was held on Monday afternoon to consider some alterations in the rules, recently decided on by the Council. It was agreed to raise the entrance fee to the Society from £3 to £5, and to augment the life-composition accordingly, relief being, however, granted by a diminution of the commutation fee to members of long standing. Other changes were made to bring the laws into harmony with the present practice of the Society in several minor matters. The meeting also passed a resolution associating itself with the act of the Council in no longer withholding the Fellowship of the Society from women.

MR. JOSEPH THOMSON'S JOURNEY TO LAKE BANGWEOLO.

MR. JOSEPH THOMSON read a paper on his expedition to Lake Bangweolo in 1890–91 to the Royal Geographical meeting on Monday night. The paper was not only of a thoroughly scientific character, but also a model of literary grace, Mr. Thomson having the trained eye which enables him to detect and throw into prominence the really important features. The expedition went up the Zambesi by way of the Kwakwa creek, encountering considerable hostility and obstruction from the Portuguese authorities on the way. Mr. Thomson speaks warmly of the great work done by the Scottish missionaries in the Blantyre and Nyassa districts. Under the kind but firm control of the missionaries the warlike Angoni tribes came in thousands to cultivate the fields, which formerly they visited only for plunder, and for the first time in all his African travels Mr. Thomson found a spot where the advent of the white man was an unmitigated blessing to the natives.

Barometric observations made while waiting for porters on the western coast of Lake Nyassa made the elevation of the lake 1430 feet, a somewhat lower result than was formerly arrived at. On August 23, 1890, the expedition, comprising Mr. Grant, Mr. Charles Wilson, and 153 porters, started from Kotakota and struck westward through unmapped country, a rough and sparsely wooded plateau with little running water. The route lay along a strip of debateable ground, inhabited by an excitable, warlike tribe, and raided equally by Mwasi's people from the north and Mpeseni's from the south. Great tact was required to avoid bloodshed, but the expedition passed safely. Then crossing the fine fertile plain of the Loangwa river, they passed over and climbed the steep Muchinga mountains to the high plateau beyond. So far the rocks had been metamorphic, with intruded masses of granite, overlaid in the valley by sandstones, shales, and marls. At one place great fossil-tree trunks were found. The Loangwa-Kalue plateau was magnificent country, glorious with the tints of early spring on the stunted trees which formed a scraggy forest over most of the surface. But no sign could be seen of the Lokinga mountains, nor was any word heard from the natives of that range so conspicuous on the maps; but on the watershed of the plateau, 5000 feet above the sea, rose the Vimbe hills in a series of isolated domes, perhaps rising 1000 feet higher. A new lake, thirty square miles in area, was found in a dip of the plateau, and named after the Moirs. Then troubles began. Small-pox broke out amongst the porters, and when Chitambo's was reached no trace could be found of the lake, on the margin of which it was supposed to stand. While the white members of the expedition were attending to their sick followers some of the healthy Swahilis marched to Old Chitambo's (which is not in Ilala but Kalinde), now deserted, and twenty miles distant from the present village, finding the tree under which the heart of Livingstone was buried still standing, and the inscription on it legible. In the dry season the Chambeze does not enter Lake Bangweolo at all, but flows direct across the marsh to the Luapula, but in the wet season

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the whole of the great marsh to the south is flooded up to Chitambo. The level at that time was made out to be 3750 feet, about 250 feet lower than Livingstone's estimate. After a rest for recovering health the expedition followed the Luapula eastward through fertile country, and leaving it where the curve from the north occurs, struck across for the Kafue, but small-pox reappeared, the land was ravaged by half-caste Portuguese slave-raiders, Mr. Thomson himself fell ill, and the course had to be changed to the south with the hope of turning west again. But matters got worse instead of better, and after touching the borders of Manica, a return had to be made to Lake Nyassa, along the southern margin of the plateau, through deep valleys, and climbing the steep slopes of the Muchinga Mountains, here separated by the great parallel valley of the Lukosashe from the plateau. All the way the land was seen to be of immense possibilities for cultivation, but neglected, and inhabited by a wretched people governed by Mpeseni, himself the vilest of them all. Kotakota on the lake was reached again on January 4th, 1891, after a total journey of 1200 miles, which resulted in many important rectifications of position and much information as to the future possibilities of the plateaux.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Dr. Hobson, late deputy Lowndean Professor, has been elected a representative of the Mathematical Board on the General Board of Studies.

Plans for a handsome building to serve as the Sedgwick Memorial Museum of Geology have been submitted to the Senate, the estimated cost being £26,000. Four members of the Syndicate appointed to prepare the plans dissent from the report of the majority, chiefly on the ground that the internal arrangements are unsatisfactory, and that the cost, initial and annual, of the proposed building will be excessive. The divergent views held on the subject will be discussed by the Senate on Saturday, December 3.

The Senate have agreed to confer on Sir R. S. Ball, the new Lowndean Professor, the complete degree of M.A., *honoris causa*.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, November 11.—Mr. Walter Baily, M.A., Vice-President, in the chair.—The discussion on Mr. Williams's paper, the dimensions of physical quantities, was resumed by Dr. Burton. He remarked that the idea that so-called "specific quantities," such as specific gravity, are pure numbers was an erroneous one, and liable to lead to difficulties. The specific gravity of a substance was of the nature of density, and was only a simple number on the convention that the density of water was taken as unity. If dimensions be given to specific quantities their interpretation would, he thought, be easy when the rational dimensional formulæ were found. Referring to Prof. Fitzgerald's comments, he said, although the contention that all energy is ultimately kinetic could not be gainsaid, the distinction commonly drawn between kinetic and potential energy involved nothing contrary to this view, and was useful and convenient in many cases. As to the dimensions of μ and k he was inclined to favour Mr. Williams's views, for several considerations suggest that the two capacities of the medium are essentially different. Arguments to show that μ was probably absolutely constant in the ether, whilst k might be variable, were brought forward. Of the two systems of dimensions for μ and k suggested by Mr. Williams, that which made μ a density seemed preferable.—Prof. A. Lodge said he was greatly interested in propagating the idea that physical quantities are concrete, and therefore welcomed Mr. Williams's paper. He thought it desirable to keep some names for abstract numbers, and "specific gravity" should be one. If another name involving dimensions was required "specific weight," or "weight per unit volume," might be used. Speaking of the dimensions of the various terms of an equation he did not think it was usually recognized that in ordinary algebra or Cartesian geometry the principle of directed terms was rigidly adhered to, for if directed at all every term of such an equation was directed along the same line. In this respect ordinary algebra was more rigid than vector algebra. Even if circular functions were involved, as in polar co-ordinates, they had the effect of making the directions of the terms the same. Other instances of problems bringing out the same fact were mentioned. Mr. Boys thought Mr. Madden had been arguing in a circle when he spoke of the astronomical unit of mass, and deduced the dimensions of mass as L^3/T^2 from the equation $MLT^{-2} = M^2/L^2$, for it was quite impossible that this equation could be true unless γ, the gravitation constant, was introduced on the right-hand side. Mr. Williams's method was quite the reverse, for he maintained that unless k and μ were introduced in the dimensions of electric and magnetic quantities, their dimensional formulæ could not indicate the true nature of those quantities, and hence were open to objection. Mr. W. Baily, whilst agreeing with Mr. Williams on most essential points, thought the total omission of L from dimensional formulæ made the expressions more complicated and less symmetrical. For example, such expressions as XY/Z, X^2 and XYZ, which respectively represent undirected length, area, and volume, might with advantage be written L, L^2, and L^3 respectively. The restriction of the dimensions of μ and k to those which give interpretable dimensional formulæ for electrical and magnetic quantities seemed scarcely justified. Both the systems proposed could not be right, and he thought it would be more in accordance with our present want of knowledge, if a quantity U of unknown dimensions were introduced such that μ or $k = U^2$. density and k^{-1} or $\mu^{-1} = U^2$. rigidity. This would keep in view the fact that the absolute dimensions of quantities involving U were unknown. A list of the dimensions of the various quantities based on this arrangement was given. Mr. Swinburne, referring to the conventional nature of many units, said great differences exist between the ideas held by different persons about such units. Starting with the convention that unlike quantities could be multiplied together, he might have six ampères flowing in an electric circuit under a pressure of ten volts, and he might say he had sixty volt-ampères. The term "volt-ampère" could be regarded as indicating that the sixty was the numerical result of multiplying a number of volts by a number of ampères, or on the other hand it might be understood as a new unit, a *watt*, compounded of a volt and an ampère. Before Prof. Rücker's paper on suppressed dimensions was published, an electrician might have suggested measuring the length of a bench by sending an alternating current through it and determining its self-induction, which he regarded as a length. Prof. Rücker, however, would say that this could not give the right result, for μ must be taken into account. He was inclined to think that dimensions were liable to mislead. Referring to scientific writers as authorities, he said Maxwell had been careless in some cases, for he had sometimes given dimensional formulæ as zero, which really ought to have been $L^0 M^0 T^0$, or unity. In French text-books the errors had been corrected. Mr. Williams, in reply to Mr. Madden's remarks about self-induction being a length, pointed out that the subject might be looked at in two different ways, depending on whether one thinks of the *standard* of self-induction as the practical standard of measurement, or the *unit* of self-induction as a physical quantity. In the former case the *standard* was a length, but in the latter the *unit* was a quantity of the same *species* as self-induction, the nature of which was as yet unknown. If its dynamical nature was known, then the absolute dimensions of all other magnetic and electric quantities would also be determined. In answer to Prof. Fitzgerald's remarks he said it was hardly likely that he should be unacquainted with the common view that kinetic and potential energies were ultimately quantities of the same kind, for it was a view with which he was quite familiar. The fact that they have the same dimensions was sufficient to show their identity, and the idea that all energy is ultimately kinetic was fundamental to his paper. This, however, did not imply that electrification and magnetization are of necessity the same, and the suggestion that they may be the same was only one of several "probable suggestions," all of which were entitled to consideration. His chief reason for regarding Prof. Fitzgerald's suggestion as probably incorrect was that it led to a system of dimensional formulæ incapable of rational mechanical interpretation, and containing fractional powers of the fundamental units. Prof. Fitzgerald's system would make resistance an abstract number, and μ and k directed quantities, whereas the former was a concrete quantity and the two latter must be scalar in isotropic media. If he (Mr. Williams) had erred in treating electrification and magnetization as different phenomena he could only plead that he had

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